NOTES ON CULICIDAE, WITH DESCRIPTIONS OF NEW SPECIES.

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Genus Anopheles, Mg.

A. (Coelodiazesis) plumbeus, Hal.

The life-history of this species has recently been fully described by Christophers (Ind. Jl. Med. Res., iii, Jan. 1916, p. 489) from larvae obtained in tree-holes in the neighbourhood of Simla. It is somewhat surprising that a species of *Anopheles* should have such a wide range, especially since tree-breeding mosquitos are usually more local in their distribution than other kinds. I believe, however, that Christophers was perfectly correct in his conclusion that *A. barianensis*, James, is the same species as *A. plumbeus*, Hal.

I had on several occasions looked in vain for larvae of *A. plumbeus* in tree-holes and elsewhere, until in April last I succeeded in finding numbers of larvae, associated with those of *Ochlerotatus geniculatus* (see below) in holes in beech trees at Burnham Beeches, Bucks. These larvae agree closely with Christophers' description and figures, the only difference I can detect being that the " triradiate spines " to which Christophers refers do not seem to be so strongly developed.

The larvae were kept for a fortnight in the water in which they were found, together with some of the leafy debris which it contained, but they appeared to make no growth at all. The same was true of specimens which were isolated in tubes without debris, but with small larvae of *O. geniculatus*. After this lapse of time fragments of crushed flies were added to the tubes and also to the main receptacle. All the *Anopheles* larvae at once clustered round and fed voraciously, some of them pupating very shortly afterwards. These experiments entirely confirm Christophers' conclusion that the larvae depend mainly for their food upon insects which fall into the water of the tree-holes; they do not appear to feed, as does *O. geniculatus*, on the vegetable debris at the bottom; nor, it seems, do they attack these other larvae, although the latter were always present in the tree-holes in which I found *A. plumbeus*.

According to Dyar and Knab, the larvae of the North American *A.* (*Coelodiazesis*) *barberi* prey upon those of *Aëdes* (*Ochlerotatus*) *triseriatus* (which is the North American representative of *O. geniculatus*). From this difference of habit, as well as from the quite considerable larval differences shown by the figure in Howard, Dyar and Knab's monograph, it seems probable that *A. barberi* is a distinct species from *A. plumbeus*. I have not however seen the American form. *A. plumbeus* is a common blood-sucker in wooded districts in this country, often biting in the daytime.

There evidently may be at least two broods of *A. plumbeus* in the year, as I found young larvae in a hole at the base of a beech tree in Cassiobury Park, Watford, on 21st August. In this case also the *Anopheles* larvae were associated with those of *O. geniculatus*.

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Genus Toxorhynchites, Theo.

Toxorhynchites regius, Tennent.

Culex regius, Tennent, "Ceylon," p. 268 (1859).

Megarhinus immisericors, Theo., Mon. Cul. i, p. 225 (1901).

Megarhinus gilesii, Theo., Mon. Cul. i, p. 227 (1901).

Toxorhynchites immisericors, Theo. et auct. (*nec* Walk.).

The only description given by Tennent is "one with a formidable hooked proboscis," but this is sufficient to identify the species, since apart from the rare and inconspicuous *T. minimus* it is the only member of the genus which is known to occur in Ceylon. Theobald also states that he has seen Thwaites' specimens to which Tennent referred.

Toxorhynchites subulifer, Dol.

Megarhinus subulifer, Dol., Nat. Tijd. Ned. Ind., xiv, p. 382 (1857).

Megarhinus immisericors, Walk., Proc. Linn. Soc. London, iv, p. 91 (1860).

On re-examining Walker's types (from Celebes) I find they are distinct from the Oriental form which has been commonly known as *T. immisericors*, and therefore this name could not be used even if *C. regius* had not been published a year earlier. The chief points of difference are that in the Celebes species there are no lateral yellowish spots on the third and fifth abdominal tergites, while the fifth and sixth sternites are almost entirely purple, instead of being yellowish with a rather narrow purple stripe down the middle. There seems to be nothing in Doleschall's description of *M. subulifer* to distinguish it from *T. immisericors*, and as both were described from the Australasian region it will probably be safe to assume that they are the same. By so doing the confusion will be avoided which would result if Walker's name were now used in a different sense from that in which Theobald employed it. Doleschall's *M. amboinensis* is evidently a different species.

Genus Aëdes, Mg.

After further study of both larvae and adults of a large number of species of the *Aëdes* group, I am now inclined to accept the view of Dyar and Knab that it will be most convenient to include almost all these forms within the single genus *Aëdes*, chiefly owing to the fact that there are so many intermediate forms, as regards the structure and length of the palpi and the shape of the scales, that any clear-cut division, even on unisexual characters, would seem to be impossible. The diversity of structure however is very much greater than it is in *Anopheles*, and it may therefore be justifiable to retain as subgenera some of the groups which have hitherto been regarded as genera. The number and exact limits of these subgenera cannot be decided upon until the mosquitos of this group are more thoroughly known; the following are rough definitions of the most important groups, but allowance must always be made for annectent species.

(1) Subgenus *Armigeres*, Theo.—Larval siphon without pecten; tuft minute or absent. Claspers of male genitalia usually with numerous articulated spines, very rarely only one. Male palpi always (so far as known) long, thin, without hair-tufts. Female claws always toothed; middle claws of male usually equal. Dark species with dark legs and flat scales on the head and scutellum.

Owing to the larval and male genital structure this is perhaps the most distinct of the subgenera of the *Aëdes* group, and were it not for the fact that I can find no definite character to separate the females from *Aëdes* I should prefer to retain it as a distinct genus.

(2) Subgenus *Stegomyia*, Theo.—Larva: antennae short, cylindrical, without microscopic spines, the tuft minute and never more than two-haired; frontal hairs always single; comb-scales in a single row. Male genitalia: claspers with a single terminal or subterminal articulated spine; side-pieces without apical lobes; unci usually more or less brush-like or pectinate. Male palpi usually long, thin, and without hair-tufts; quite short in two species (*annulirostris* and *thomsoni*). Female claws toothed or not. Female abdomen without distinct cerci, the eighth tergite prominent, but not the eighth sternite. Usually ornate species, frequently black and white, with conspicuous white rings on the legs; flat scales on head and scutellum.

(3) Subgenus *Ochlerotatus* (Arr.) Edw.—Larva: antennae longer than in *Stegomyia*, usually more or less curved and tapering, and covered with microscopic spines; tuft well-developed and nearly always many-haired; frontal hairs usually multiple; comb-scales nearly always in a triangular patch. Male genitalia very diverse, but the claspers with a single articulated spine, which may or not be terminal. Male antennae with the verticillate hairs more numerous dorsally and ventrally. Male palpi usually long, with the last two joints somewhat swollen, hairy and bent downwards; in a few species (*eatoni*, etc.) only about half as long as the proboscis. Female claws almost always toothed. Female abdomen with distinct projecting cerci, except in one group. Ornamentation very diverse.

The further classification of this subgenus is dealt with below.

(4) Subgenus *Aëdes*, Mg.—Larva, so far as known, like that of *Ochlerotatus*. Male genitalia extremely diverse, even in closely allied species; claspers without articulated spine, sometimes much reduced. Male palpi very short. Male antennae with the verticillate hairs less numerous and more evenly distributed than in *Ochlerotatus*. Female claws toothed. Female abdomen with distinct cerci. Dark species, not strikingly ornamental; head mainly covered with flat scales.

(5) Subgenus *Skusea*, Theo.—Larva not yet described. Male genitalia with five or six long processes which have apparently been derived from the basal lobes of the side-pieces, but in some cases have become nearly apical, resembling the somewhat similar structures of *Culex*. Male palpi long, hairy towards tip (*pembaensis*), long, thin and bare (*amesii*) or quite short (*simplex*). Female claws simple. Female abdomen pointed, as usual, and with distinct cerci.

Subgenus Armigeres, Theo.

The Oriental species of this subgenus are numerous and difficult to separate; the following is an attempt at a table of those in which the female palpi are short. A table of those (*Leicesteria* group) which have the female palpi more than half as long as the proboscis has been given previously.

1. Hind femora on the outer side dark apically 2
   Hind femora on the outer side white to the tip 3
2. All tibiae about equal in length .. .. *moultoni*, Edw.
   Hind tibiae distinctly the shortest .. .. *brevitibia*, Edw.

3. Abdominal tergites with apical yellowish bands .. .. *apicalis*, Theo.
   No such bands present; tergites black with white lateral spots 4
4. Thorax with distinct fine golden lines; white lateral spots on abdominal tergites extending dorsally towards apices of segments.. .. *aureolineatus*, Leic.
   Thorax usually dark above; abdomen differently marked 5
5. Abdominal sternites with black apical bands 6
   First six abdominal sternites entirely white 7
6. Mesonotum with distinct pale margin: dark bands on sternites 3–6 all about equal in width .. .. *obturbans*, Walk.
   Mesonotum without distinct pale margin; dark bands on sternites 3 and 4 much broader than those on 5 and 6 .. .. .. *durhami*, sp. n.
7. Seventh sternite black 8
   Seventh sternite white 11
8. Sides of mesonotum in male broadly, in female narrowly silvery .. .. *confusus*, Edw.
   Mesonotum in both sexes dark, without a distinct pale margin 9
9. Claspers of male genitalia with only four teeth .. .. *conjungens*. Edw.
   Claspers with 15–20 teeth 10
10. Basal lobes of side-pieces of male genitalia with three flattened appendages, with rounded tips .. .. *hybridus*, Edw.
    These appendages pointed and spine-like .. .. .. *kuchingensis*, Edw.
11. Mesonotum dark, without distinct pale margin .. .. *malayi*, Theo.
    Margins of mesonotum broadly silvery in male 12
12. Integument of thorax blackish (usually); male genitalia with a single weak spine on the basal lobes of the side-pieces .. .. *jugraensis*, Leic.
    Integument of thorax more reddish; basal lobes of side-pieces with three flattened plates .. .. *maiae*, sp. n.

Armigeres brevitibia, Edw.

This species was described from a single female from Kucking, Sarawak. Since the description appeared in print, additional specimens representing both sexes have been received from the same place; these were probably collected by Mr. J. Hewitt, and bear the following label: "bred from curious yellow long-lived larvae of about $\frac{2}{3}$ in. long. Pupa lasted $7\frac{1}{2}$ days. Aug. 1905."

The following structural characters of the male may be noted:—Palpi of the usual form, long, thin and upturned, considerably longer than the proboscis. Front and middle claws very unequal, the larger simple, the smaller in two specimens with a small tooth near the base, in a third simple. Genitalia: claspers long, thin, slightly swollen towards the tip, with a single short thick terminal spine; basal lobes of side-pieces hairy, but without differentiated spines or bristles; lobes of ninth sternite rather prominent and densely hairy; harpes and uncі as in the other species. Under side of abdomen almost entirely dark.

The structure of the male claspers shows that this species is not at all closely related to any others in the subgenus; in fact, it is only included here, rather than in *Stegomyia*, owing to its general similarity in colouring to *A. obturbans*.

Armigeres aureolineatus, Leic. (fig. 1).

Originally described from the Malay Peninsula, this species has since been recorded from Sarawak and Ceylon. As already noted by Leicester, the markings of the abdomen are very similar to what is found in the *Leicesteria* group, although the male genitalia closely resemble those of the *Armigeres* group. A figure of these organs is given herewith (fig. 1).

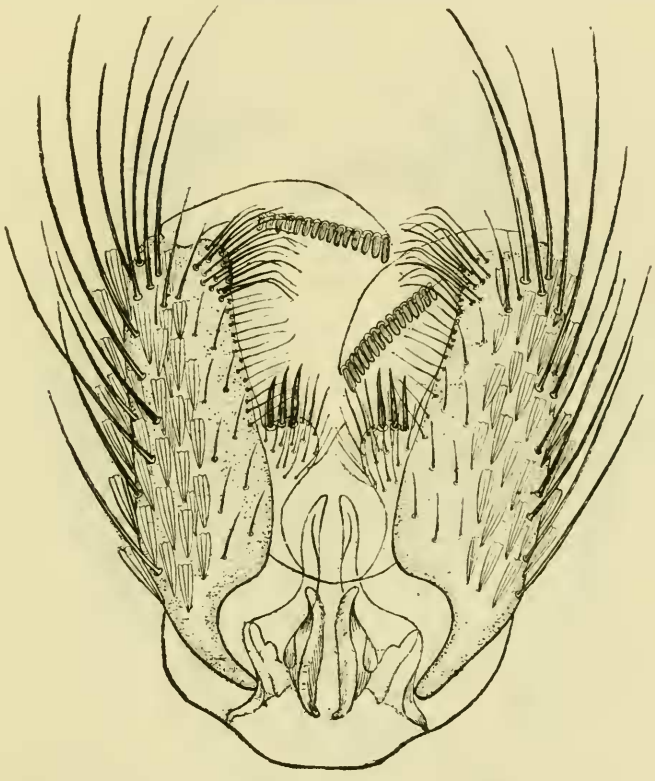

Fig. 1. *Armigeres aureolineatus*, Leic.: male genitalia.

Armigeres obturbans, Walk. (fig. 2).

Armigeres panalectoros, Giles, Gnats, Ed. ii, p. 386 (1904).

Both *A. obturbans* and its synonym *A. ventralis* were described from specimens from the Australasian region (Amboyna and Celebes), and therefore it seems open to question whether the common Indian and Chinese species is really correctly named. Walker's types in the British Museum however appear to agree with Indian specimens, and therefore the name may be retained for the present at least.

The species is subject to considerable variation in colour, particularly in the amount of pale scaling on the mesonotum. This is especially the case in a long series received from Hong Kong; some specimens from this locality show thoracic markings very much as figured by Giles for *A. panalectoros*, though less sharply defined, yet these

specimens agree in other respects, including genital structure, with *A. obturbans*. There can be little doubt therefore that *A. panalectoros* is only a form of *A. obturbans*, although the type male from which Giles described it is apparently lost.

The genitalia of *A. obturbans* are shown in fig. 2; as will be seen by comparison of this with Theobald's figure (Mon. Cul. iii. p. 138), the latter is very inaccurate.

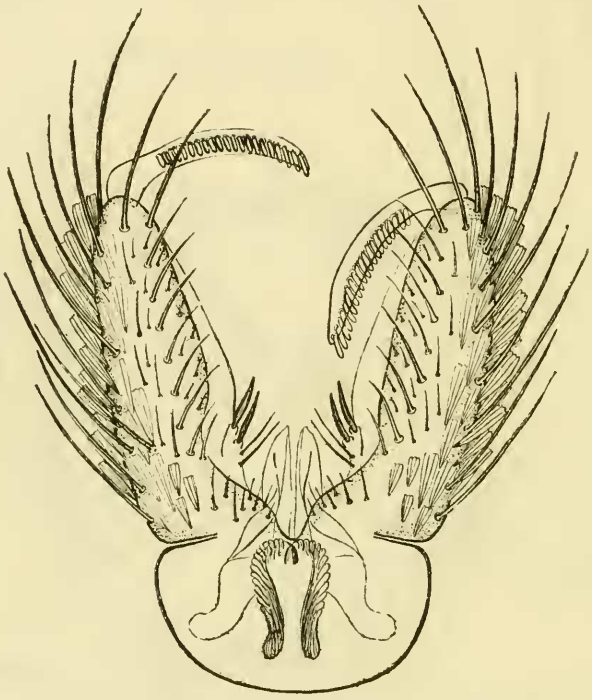

Fig. 2. *Armigeres obturbans*, Walk.; male genitalia.

Armigeres durhami, sp. nov.

Differs from *A. obturbans* by the characters indicated in the key, and also in the male genitalia, as follows:—Side-pieces rather shorter and stouter, their basal lobes with three flattened spiny bristles, much as in *A. kuchingensis*; claspers with a distinct swelling on the flexor surface a little beyond the middle.

Fed. Malay States: Bukit Kutu, 3,300 ft. Type male and one female bred from larvae in tub near bungalow, 11.v.1903; a second female caught at same place on same day, and a third 17.v.1903 (*Dr. G. F. Leicester*); also 3 ♀ from same place, 20.ii.1903 (*Dr. Durham*).

All specimens in the British Museum; those collected by Dr. Durham were named by Theobald *Desvoidya fusca*.

Armigeres malayi, Theo. (fig. 3).

Uranotaenia malayi, Theo., Mon. Cul. ii, p. 258 (1901).

Desvoidea fusca, Theo., Mon. Cul. iii, p. 135 (1903) (types only).

Theobald wrongly described the claws in the type of his *U. malayi* as simple ; they are really toothed, and the specimen is quite recognisable as a small example of this species. The type male and female (so labelled by Theobald) of *D. fusca* are from Jugra, not Kuala Lumpur ; the middle claws of the male are now missing, but it may be

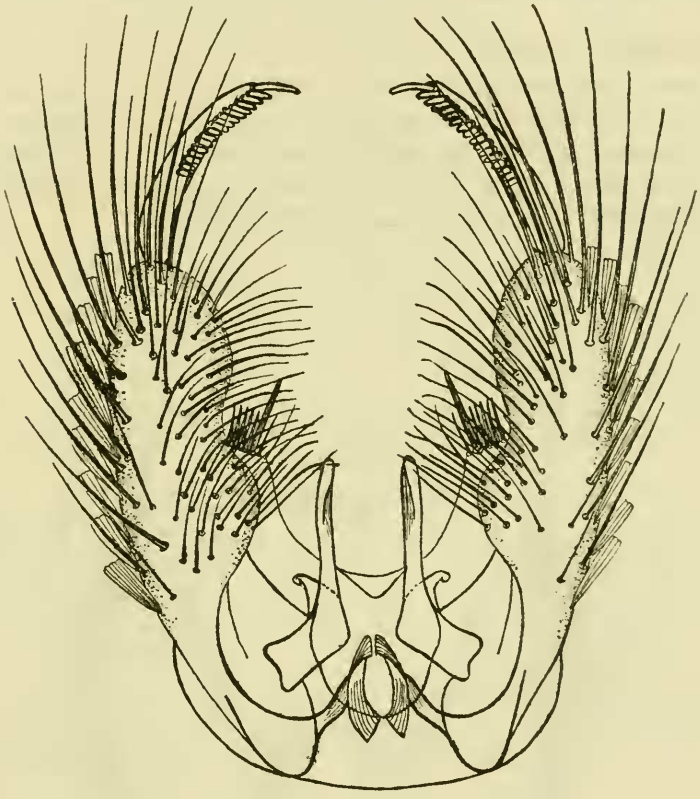

Fig. 3. *Armigeres malayi*, Theo. ; male genitalia.

surmised that they were inaccurately figured. The specimens labelled by Dr. Durham as having been bred from the foul water in a stable catch-pit at Kuala Lumpur, which are the only ones Theobald mentions having examined, are *A. obturbans* and not *A. malayi*. The proper significance of the name *fusca* is therefore doubtful, but fortunately it need not be used, since *malayi* and *obturbans* are both of prior date.

The genitalia of this species are remarkably distinct, and are shown in fig. 3. From Taylor's description of the genitalia of *Neosquamomyia breinli* (Trans. Ent. Soc., 1914, p. 186) it is evident that this Papuan species is an *Armigeres* closely related to *A. malayi*.

Armigeres jugraensis, Leic.

Leicester's series consisted of two distinct species, which can readily be separated on male genital characters, although in other respects they are very similar. The specimens Leicester refers to as having been bred from "larvae found in a bamboo in Ampang jungle and in water collected in a fallen leaf in the jungle at Jugra" are however the same, and it is evident the name *jugraensis* must be restricted to them, as the other specimens were not definitely mentioned by Leicester.

In the true *A. jugraensis* the male genitalia are very similar to those of *A. obturbans*, but both the side-pieces and the harpes are shorter and stouter.

Armigeres maiae, sp. n. (fig. 4).

Differs from *A. jugraensis* as indicated in the key. Male genitalia, fig. 4.

Fed. Malay States: Kuala Lumpur district (*Dr. G. F. Leicester*); 1 ♂ labelled "5th mile Gombak Rd., jungle, midday, 29.ii.1904"; five ♀ from same place, 5.xii.1903 and 12.xii.1903; 1 ♂ (type) "jungle, Pahang Rd., 6 miles from Kuala Lumpur, 15.v.1904"; and one other ♂ without exact data.

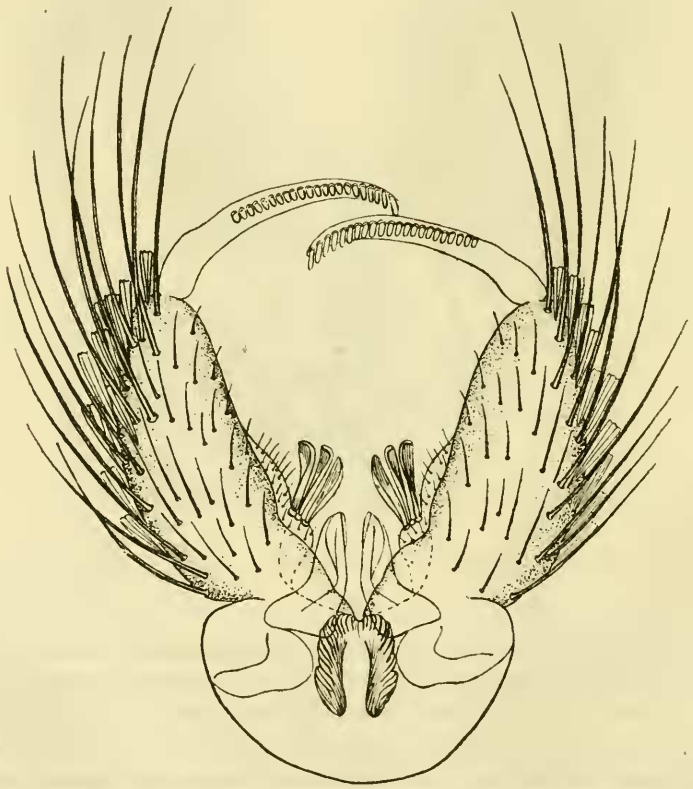

Fig. 4. *Armigeres maiae*, Edw., sp. n.; male genitalia.

This species is dedicated to my wife, to whom I am indebted for the four drawings of *Armigeres* genitalia now published.

Subgenus Stegomyia, Theo.

Stegomyia variegata, Dol. (fig. 5 *a*).

Culex variegatus, Doleschall, Nat. Tijd. Ned. Ind. xvii, p. 77 (1858).

Culex scutellaris, Walker, Proc. Linn. Soc., London, iii, p. 77 (1859).

Culex zonatipes, Walker, Proc. Linn. Soc., London, v, p. 229 (1861).

Stegomyia pseudoscutellaris, Theobald, Entomologist, xliii, p. 156 (1910).

A careful re-examination of the types of Walker's *C. zonatipes* and *C. scutellaris* shows that Theobald was mistaken in referring the former to *S. fasciata*, F., and in identifying the latter with the common Oriental species. Both are in fact unquestionably the same as the species Theobald subsequently described as *S. pseudoscutellaris*. The oldest of these names is *scutellaris*, and if this name were to be used to replace *pseudoscutellaris* endless confusion would be caused, but fortunately it seems practically certain that Doleschall's *C. variegatus*, described a year earlier than *scutellaris*, is also the same species, since he refers to the white line round the margin of the thorax. The name *Culex variegatus* had been used for two different species by Schrank and Blanchard before it was employed by Doleschall, but although neither of these species can be recognised, it is quite clear that neither of them belong to *Stegomyia*. As I have adopted the principle that a homonym can be revived when transferred to a fresh genus, provided it is not pre-occupied there also, I propose to use the name *S. variegata* (Dol.) for this species. This may not be strictly in accordance with the letter of the rules regulating zoological nomenclature, but it appears to me to be reasonable, and is moreover in line with the view taken by several leading entomologists.

S. variegata was recorded by Doleschall from Amboyna, and by Walker from Aru and New Guinea; specimens have been received at the British Museum from Fiji, Solomon Islands, New Caledonia and Christmas Island (S. of Java); Taylor has also recorded it from Samarai I. (Proc. Linn. Soc. N.S.W., xxxix, p. 456). Apart therefore from its occurrence at Christmas Island, where it was found in large numbers by Dr. C. W. Andrews, *S. variegata* seems to be a purely Australasian species; it is surprising that it does not appear to have been found on the continent of Australia. The genitalia (fig. 5 *a*), especially as regards their basal parts, are very different from those of *S. albopicta* (fig. 5 *b*).

Stegomyia albopicta, Skuse (fig. 5 *b*).

Culex albopictus, Skuse, Indian Mus. Notes, iii, no. 5, p. 20 (1895).

Stegomyia scutellaris, Theobald, Mon. Cul. i, p. 298 (1901).

Stegomyia scutellaris var. *samarensis*, Ludlow, Jl. N.Y. Ent. Soc. (1903).

Stegomyia samarensis, Ludlow, Psyche, xviii, p. 127 (1911).

The common Oriental species at present known as *S. scutellaris* must in future be called *S. albopicta*, since this appears to be the oldest available name. Apparently it is not absolutely confined to the Oriental region, as Taylor has recorded it from Papua (Trans. Ent. Soc., London, 1914, p. 189) and N. Australia (Proc. Linn. Soc. N.S.W., xxxix, p. 455). Except for a specimen from Honolulu, however, there are no Australasian specimens in the British Museum.

Stegomyia vittata, Bigot.

Culex vittatus, Bigot, Ann. Soc. Ent. France, (4) i, p. 227 (1861).

Stegomyia sugens, Theobald, Mon. Cul. i, p. 300 (1901), et auct. (*nec* Wied.).

Stegomyia brumpti, Neveu-Lemaire, Bull. Soc. Zool., France, xxx, p. 8 (1905).

Reedomyia albopunctata, Theobald, Mon. Cul. iv, p. 262 (1907).

There is unfortunately little or no doubt that Theobald wrongly identified Wiedemann's *C. sugens*, since that author does not mention the white rings on the femora and tibiae, which he certainly would have done if they had been present. It is impossible to say from the description what Wiedemann's *C. sugens* really was, but if the type could be found it might perhaps prove to be a rubbed *S. fasciata*.

Stegomyia fraseri, Edw. (fig. 5 *c*).

This species was described by me (Bull. Ent. Res. iii, p. 11, May 1912) from a single female from Uganda. Since then a good series including both sexes has been received by the Imperial Bureau of Entomology from Southern Nigeria; unfortunately the names of the locality and collector have been lost. These specimens agree perfectly with the type female. The male genitalia (shown in fig. 5*c*) resemble those of *S. apicoargentea*, except in having two instead of four bristles at the tips of the harpagones. A single female has also been taken by Mr. A. Bacot at Freetown, Sierra Leone.

Stegomyia thomsoni, Theo. (fig. 5 *d*).

A series of specimens bred from larvae taken in a hollow tree have been received from Pusa, Bengal (*F. M. Howlett*). The palpi are alike in both sexes, though rather longer and more distinctly jointed than in *Aëdes*. In view of the type of ornamentation of this species and also of the structure of the male genitalia (fig. 5 *d*), it seems best placed in *Stegomyia*, in spite of the short male palpi.

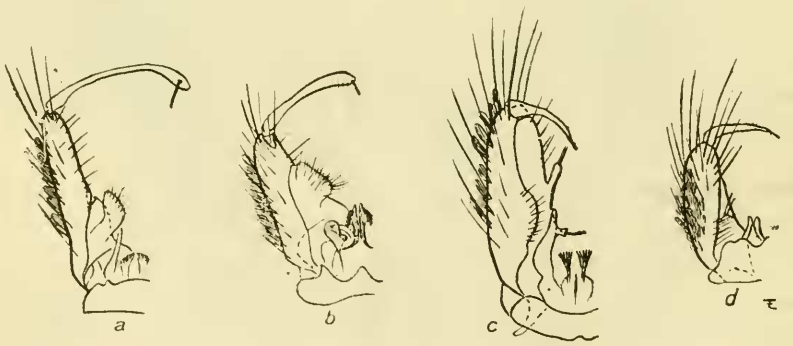

Fig. 5. Male genitalia of *Stegomyia*, ventral view:—(*a*) *S. variegata*, Dol.; (*b*) *S. albopicta*, Skuse; (*c*) *S. fraseri*, Edw.; (*d*) *S. thomsoni*, Theo.

I have also seen a male of *S. annulirostris*, Theo., taken by Major S. P. James in Ceylon; this species, which is evidently nearly allied to *S. thomsoni*, also has the palpi alike in the two sexes.

Subgenus OCHLEROTATUS (Arrib.), Edw.

Group *Finlaya*, Theo.

Finlaya, Theo., Mon. Cul. iii, p. 281 (1903).

Danielsia, Theo., Entom. xxxvii, p. 78 (1904).

Hulecoetomyia, Theo., Entom. xxxvii, p. 163 (1904).

Popea, Ludl., Can. Ent. xxxvii, p. 95 (1905).

Phagomyia, Theo., Gen. Ins. Cul. p. 21 (1905) (type, *P. gubernatoris*).

Lepidotomyia, Theo., Gen. Ins. Cul. p. 22 (1905) (type, *L. magna*).

Protomacleaya, Theo., Mon. Cul. iv, p. 253 (1907) (type, *P. triseriata*).

Pseudocarrollia, Theo., Rec. Ind. Mus. iv, p. 13 (1910).

This group can apparently be distinguished from *Stegomyia* and from *Ochlerotatus* (s. str.) by the characters of the female abdomen, the eighth sternite being very large, much larger than the tergite, and always exserted in repose: the cerci are always short. This character can be seen best in side view, the tip of the abdomen being laterally compressed. The male palpi are more or less intermediate between those of *Stegomyia* and *Ochlerotatus* (s. str.), most of the species having the last two joints slightly swollen and rather hairy; a few species (*trilineatus*, *japonicus*, etc.), which I propose now to include here on account of the structure of the female abdomen, have the male palpi almost exactly as in *Stegomyia*.

The male genitalia are of a fairly uniform type: the side-pieces without basal or apical lobes; the claspers simple, with a long terminal spine (rarely short); the harpagones well developed, with the terminal appendage long, curved and filamentous.

The scale characters, as usual, are extremely variable in different species, but most of the species are highly ornamented in one way or another. *O.* (*F.*) *poicilia* and its allies are at first sight very different from most of the other species, and have some peculiarities in the male genitalia, but they are approached in this respect by *O.* (*F.*) *pulchriventer*, while the structure of the female abdomen is normal.

The group is probably a natural one, since all the species, so far as known, are tree and plant breeders, but neither in larval nor adult characters is it possible to draw any sharp or satisfactory distinction from the other genera or subgenera of the *Aëdes* group. Some at least of the larvae have much more numerous branched hairs on the abdomen than is usual in *Ochlerotatus*.

The following species may be included in this group :—

Nearctic Region: *triseriatus*, Say. Palaearctic Region: *geniculatus*, Ol. (=*lateralis*, Mg.); *eatoni*, Edw.; *oreophilus*, Edw.; *pulchriventer*, Giles; *japonicus*, Theo.; *togoi*, Theo.; *macfarlanei*, Edw. Ethiopian Region: *longipalpis*, Grünb. (*wellmani*, Theo., and *fascipalpis*, Edw., may also belong here, but the structure of the female abdomen is more like that of *Stegomyia*). Oriental Region: *poicilia*, Theo.; *flavipennis*, Giles; *gubernatoris*, Giles; *melanopterus*, Giles; *lophoventralis*, Theo.; *trilineatus*, Theo.; *albotaeniatus*, Theo.; *niveus*, Ludl.; *pseudotaeniatus*, Giles; *greeni*, Theo.; *leucomeres*, Giles. Australasian Region: *notoscriptus*, Skuse; *australiensis*, Theo.; *kochi*, Dön.

Ochlerotatus (F.) geniculatus, Ol.

The early stages of this species have never been described, nor is there any certain record of its breeding habits, though Galli-Valerio and Rochaz de Jongh,* in recording that they have found larvae of *C. ornatus* in holes at the bases of trees, are very probably referring to *O. geniculatus*.

Early in April of the present year (1916) I found large numbers of larvae, in company with those of *Anopheles plumbeus*, in holes in beech trees at Burnham Beeches, Bucks. The larva is peculiar in several respects, having a greater resemblance to those of *Stegomyia* than to those of *Ochlerotatus*. The following description should make it easily recognisable :—

Antennae rather long, almost straight, slightly tapering towards the tip ; a single hair in place of a tuft about the middle ; no trace of minute spines over the surface. *Frontal hairs* : the usual four pairs present, two large and two smaller ; of the two larger pairs the anterior is two-branched, the posterior simple, almost in a line longitudinally with the anterior pair ; both these only about as long as the antennae ; the median pair small, four- or five-branched above the base, rather close to and almost in a line transversely with the anterior (two-branched) hair. Much further back, near the edge of the clypeus, is an additional single hair. *Abdomen* with numerous rather long four- or five-branched "stellate" hairs scattered over both the dorsal and ventral surfaces. *Comb* of eighth segment with about 12 teeth in a single, regular, slightly arched row ; the teeth apparently simple and produced into long sharp points. *Siphon* about three times as long as its base, regularly narrowed towards the apex ; pecten with 14–17 teeth, all close together, in a slightly diagonal row extending only about a quarter of the length of the siphon ; the first three or four teeth short, the rest much longer, each with one or two minute serrations at the base. Tuft of four simple hairs, in a line with the apex of the pecten, placed before the middle of the siphon. *Anal segment* with a chitinous saddle, the posterior edge of which is minutely spiny and carries a long three-branched hair. None of the hairs on the anal segment, or indeed anywhere on the body, are plumose. Upper pair of gills a little longer than the anal segment, and about half as long again as the lower.

Larvae of all sizes from newly hatched to full-grown, but mostly quite small, were found in the tree-holes on 4th April ; the first adult did not hatch out till 22nd April, but some of those which were only in the first or second stage on 4th April had produced adults by 4th May.

The adult is a very vicious and persistent biter.

Young larvae of a second brood were found in a hole at the base of a beech-tree in Cassiobury Park, Watford, on 21st August.

Ochlerotatus (F.) koreicus, sp. nov.

Head with a broad patch of narrow white scales on the vertex ; on each side of this a roundish area of broader black scales ; scales at the sides flat, white, including a black spot ; narrow white scales round the upper part of the eye-margins. Clypeus bare, black. First antennal joint with small flat white scales. Palpi and proboscis

* See Review of Applied Entomology, i, 1913, p. 40. I have been unable to consult the original paper.

entirely black-scaled : palpi of female a quarter as long as the proboscis, of male slightly shorter than the proboscis, the last two joints thin, somewhat upturned, and with very few hairs. *Thorax* : prothoracic lobes and area of mesonotum behind them with flat white scales. Mesonotum blackish, with blackish brown and golden-yellow scales, the latter arranged in definite, though not very sharply defined lines as follows : a continuous margin to the mesonotum ; a median longitudinal line, forking just in front of the scutellum ; a pair of short lines on the anterior half : a longer pair on the posterior half, bent outwards at the suture. Scutellum with whitish yellow scales in the middle of the median lobe, black ones on each side of these ; these scales are narrow in the female, but much broader in the male : lateral lobes with a few black scales ; spaces between the lobes bare. Pleurae with several patches of flat white scales. *Abdomen* blackish above, the segments with brilliant white, basal, lateral spots and small, dull white, median basal patches ; on the eighth tergite the lateral spots meet in the middle. Venter black, the segments with brilliant white basal bands, which are somewhat narrowed in the middle. Eighth sternite of female with fairly numerous small flat whitish scales. *Male genitalia* : claspers strap-shaped, with a rather long terminal spine ; side-pieces without apical or basal lobes ; harpagones well developed, terminal spine long, curved, filiform. *Legs* : front pair blackish ; femora with a creamy-white patch on the basal half in front, tip also creamy-white ; rather narrow white rings at the bases of the first three tarsal joints. Mid legs similar, but the femora are whitish to the tip on the under side, the white tarsal rings are rather broader, and there is a very narrow one on the fourth joint. Hind femora white on their basal half, except for a narrow dorsal line : apical half with a broad blackish ring, narrower beneath ; tips more broadly white than in the other legs ; tarsal rings also broader, and there are a few white scales at the base of the fifth joint. Fore and mid claws toothed, in the male the larger claw with two teeth. *Wings* densely brown-scaled ; scales of the lateral series rather broadly linear. Upper fork-cell with its base rather nearer the base of the wing than that of the lower. *Halteres* with bare yellowish stem ; knob darker, with whitish scales on the outer side and darker ones on the inner.

Korea : 1 ♂ 1 ♀ collected by *Dr. R. G. Mills* and received through *Dr. A. T. Stanton* ; presented to the British Museum by the Imperial Bureau of Entomology.

O. (*F.*) *koreicus* is rather closely allied to *O.* (*F.*) *japonicus*, Theo., differing chiefly in the presence of white rings on the last two joints of the hind tarsi, in the less hairy male palpi, and the rather differently constructed harpes of the male genitalia.

Ochlerotatus (F.) fulgens, sp. nov.

Resembles *O.* (*F.*) *longipalpis*, Grünb. (= *Stegomyia pollinctor*, Graham), and is probably only a geographical form of it, but shows the following differences :— Palpi of female two-thirds as long as the proboscis, instead of only one-third. Space in front of scutellum almost covered with flat silvery scales, not largely bare. Median lobe of scutellum entirely covered with flat silvery scales, instead of having a patch of black ones in the middle. Harpes of male genitalia without the minute notch at the tip which occurs in *O. longipalpis*. Hind tibiae entirely blue-black, without any creamy patch at the base beneath. First joint of front tarsi entirely white beneath. First joint of mid tarsi entirely white on the posterior and ventral surfaces, but without

a complete white ring at the base ; second joint white except at the tip. First joint of hind tarsi entirely blue-black, no trace of a white ring at the base.

A series received from Zanzibar (*Dr. W. M. Aders*), some bred from larvae found in a hole in a mango tree, 15.v.1915 ; also 1 ♀ from Karonga, Nyasaland, ii. 1912 (*Dr. A. G. Eldred*).

Type and other specimens presented to the British Museum by the Imperial Bureau of Entomology.

Ochlerotatus (F.) melanopterus, Giles.

Finlaya melanoptera, Giles, J. Trop. Med. vii, p. 367 (1904).

Popea palawanensis, Ludlow, Psyche, xxi, p. 31 (1914).

In my paper on synonymy of Oriental Culicidae (Bull. Ent. Res., 1913) I included *F. melanoptera* under *O. gubernatoris*, thinking that the tufts of long scales might not be normal, but since Dr. Ludlow has now described other specimens which have the same scale-tufts present, *melanoptera* is probably distinct from *gubernatoris*.

Ochlerotatus (F.) lophoventralis, Theo.

Pseudocarrollia lophoventralis, Theo., Rec. Ind. Mus. iv, p. 13 (1910).

In giving this also as a synonym of *O. gubernatoris*, I overlooked the fact that the scutellum is uniformly and densely clothed with flat white scales, which is not the case in the latter species ; there are some other differences, *e.g.*, the white ring at the base of the front metatarsus of *O. lophoventralis*. Specimens have recently been received at the Museum from Pusa (*F. M. Howlett*).

Group *Diceromyia*, Theo.

Although in general ornamentation, as well as in the possession of peculiar scale-tufts on the side-pieces of the male genitalia, the species of this group resemble *O. poecilia* and its allies, they can hardly be included in the *Finlaya* group, since the eighth abdominal sternite of the female is not prominent, the terminal joint of the male palpi is minute and rounded, and the male genitalia are without harpagones. The only species which can at present be referred here are *O. furcifer*, Edw. (*Diceromyia africana*, Theo.) and the following new form.

Ochlerotatus (D.) adersi, sp. nov. (fig. 7 *a*).

Closely allied to *O.* (*D.*) *furcifer*, but differing as follows :—Proboscis without a definite pale ring, though there are numerous pale scales scattered over the basal half, these being more plentiful than the dark ones in the male. Abdominal tergites with sub-basal white lateral spots, which in some specimens are connected with basal median white bands, but without any scattered pale scales on the apical parts of the segments. There are more numerous yellowish-white scales on the front part of the mesonotum, but the scales on the scutellum are mostly black, instead of mostly white. Male genitalia similar to those figured by Theobald for *O. furcifer*, but the lateral scale-tuft has become apical through the enlargement of the inner aspect of the side-piece, and there is no apical hair-tuft such as is stated by Theobald to occur in *O. furcifer* ; clasper as figured ; harpes short ; harpagones apparently absent.

Zanzibar : Mnazi Moja, 8.v.1916, bred from larvae in hole in almond tree, 2♂ 2♀ (*Dr. W. M. Aders*).

The males and one female presented to the British Museum by the Imperial Bureau of Entomology.

The " forking " of the clasper is due to the spine being placed far back, instead of being terminal as usual; it is an exaggeration of the structure found in *O. vexans*, Mg., and allied species, and may possibly indicate a connection between these species and *O. adersi*. The tuft of brownish yellow scales at the apex of the side-pieces is almost as long as the side-pieces themselves, and is very conspicuous.

Group *Ochlerotatus*, s. str.

After the exclusion of the *Finlaya* and *Diceromyia* groups, the remainder of the genus *Ochlerotatus* consists of a very heterogeneous mass of species, some more closely allied than others. It does not appear to be possible to draw any hard and fast lines within this group, since there are so many intermediate forms. The most natural classification of the group is probably one based on the structure of the male genitalia, but unfortunately there seem to be no tangible female characters which can be associated with those of the male. The following main groups may be distinguished :

(*a*) Group *Ochlerotatus*, in the most restricted sense. Side-pieces of genitalia with well developed apical and basal lobes; claspers with a long terminal spine; harpagones well developed, with a more or less flattened articulated terminal process. Species usually without any striking ornamentation, and with narrow scales on the scutellum and vertex. This group roughly corresponds to *Culicada* as used by Theobald, and includes the majority of the European, North American and Australian species. Transitional forms to the next group are to be found in *O. annuliferus* (Ludlow) and *O. fryeri* (Theo.), in which the apical lobes of the side-pieces are absent, the harpagones small and with their terminal process short and spine-like.

(*b*) Group *Ecculex*. Side-pieces without apical lobes, but the basal lobes well developed and hairy; claspers with the terminal spine inserted at some distance before the tip, giving a forked appearance; harpagones absent. In general aspect the species resemble those of the preceding group. The following species may be included :—*O. vexans* (Mg.), *O. hirsutus* (Theo.), *O. cumminsi* (Theo.), *O. dentatus* (Theo.), *O. quasiunivittatus* (Theo.), *O. caliginosus* (Grah.).

(*c*) Group *Aëdimorphus*. Side-pieces without either apical or basal lobes; claspers usually highly specialised, though often resembling those of the preceding group; harpagones absent. This group, though on the whole a natural one, seems to merge on the one hand into the *Ecculex* group and on the other into *Stegomyia*. It includes most of the species placed by Theobald in *Aëdimorphus* and *Reedomyia*, with a few other African and Oriental species.

Ochlerotatus annulipes, Mg.

This species occurs abundantly on Wood Walton Fen, Huntingdonshire, where it is a severe daytime biter, like its ally *O. maculatus* (Mg.). A number of specimens from this locality were presented to the British Museum in 1913 by the Hon. N. C. Rothschild, by whose kind permission I visited the fen in April 1914 with the object of searching for the larvae of this species and *Aëdes cinereus*, another species which Mr. Rothschild had taken in numbers there. Although not successful in obtaining larvae of the *Aëdes*, I found large numbers of *O. annulipes* larvae in shallow temporary

pools amongst the reeds. A close examination of these larvae has failed to reveal any differences whatever between them and *O. maculatus*; a result which is not a little surprising, in view of the fact that when there are conspicuous differences in the male genitalia, as there are in these two species, they are usually associated with marked differences in the larvae.

Ochlerotatus nemorosus, Mg. (fig. 6 *a*).

This species is very abundant on Harrow Weald Common, Middlesex. The larvae appear in the temporary pools in the hollows about Christmas, and become full-grown about the middle of March, the first adults appearing towards the end of that month. Normally, as in other related species, there is only one brood in the year, and attempts to hatch out larvae in the early autumn by placing dry leaves from the hollows in water have failed. Last year (1915), however, the weather conditions were abnormal: an early spell of dry weather caused the pools to dry up completely by the middle of April, about a month earlier than usual; this was followed later on by a very wet summer, and the hollows were filled up again and remained full for several months, whereas in normal years they are dry from about the middle of May till about the end of November. Under these circumstances a plentiful second brood of *O. nemorosus* was produced in July, and the specimens of this brood were, if anything, even more vicious in their attacks than those of the first brood.

Fig. 6. Scales from the comb of the eighth abdominal segment of *Ochlerotatus* larvae:—(*a*) *O. nemorosus*, Mg.; (*b*) *O. dorsalis*, Mg.: (*c*) *O. sulinus*, Fic.

While watching one day a number of these second-brood insects feeding on my hand and ankle, I suddenly noticed that one of them was apparently a male. I at once secured it, and kept a look out for others. In about ten minutes I had taken three in the act of sucking, while a fourth had escaped. Probably more could have been secured if time had allowed, but unfortunately I had no other opportunity of visiting the locality until the mosquito season was over. A close examination later of the three specimens taken showed that none of them were normal males, but all three had one or more female characters on one or both sides of the body. It seems not improbable, therefore, that other male specimens of various mosquitos which have occasionally been recorded as biting were really partly hermaphrodite. As very few cases of hermaphrodite mosquitos have been recorded, it may be of interest to describe these examples:—

Specimen A.—Left antenna as in male, normal. Right antenna with the basal joint a little smaller than in a male: following 11 joints shorter, stouter and more hairy than in a female, but more like this sex; last two joints rather elongate, but together scarcely longer than the penultimate joint of the left antenna. Left palp about half as long as the proboscis, its tip thickened, distorted, and hairy. Right palp as in female, normal. Hypopharynx normal, as in female. Both mandibles absent.

Left maxilla normal ; right present, but abnormally slender. Left front claws male, right female ; left middle claws female, right male. Genitalia male, perfectly normal.

Specimen B.—Left antenna with basal joint as in female ; next 10 joints very short and with long hairs, but not truly male in character ; last three joints more elongate and female in appearance. Right antenna similar, but much less hairy, and the last 7 joints almost typically female. Left palp about a third as long as the proboscis, the terminal joint much larger than in the female, oval, but not very hairy. Right palp similar, but a little shorter. Hypopharynx, mandibles and maxillae normal (female). Inner left front claw longer than outer, but without a tooth ; right front claws female. Inner left middle claw longer than outer, but shorter and straighter than in male ; right middle claws normal (female). Genitalia female, quite normal.

Specimen C.—Left antenna similar to that of specimen B, but the ante-penultimate joint is shorter. Right antenna similar to the left. Left palp similar to that of specimen B. Right palp a little longer and more hairy than the left. Hypopharynx, mandibles and maxillae normal (female). Front claws female. Inner claws on mid legs a little longer than the outer, that on the left leg without a tooth. Genitalia normal, female.

Ochlerotatus dorsalis, Mg., and **O. salinus,** Fic. (fig. 6 *a*, *b*).

So far as I am aware, the larvae of these two species have never been described. They are usually found together, the larvae feeding in brackish or salt water. I found larvae at Beckton Marsh, London, E., in April 1914, and at Tal-y-bont, Merioneth, in July 1914. In the latter case the young larvae were in a rather foul puddle of brackish water immediately behind a shingle bank ; the larval and pupal stages occupied about a fortnight, so that there are evidently several generations in the year.

The larvae of both these species rather closely resemble those of *O. nemorosus*, but are easily distinguishable under a microscope. The following characters will serve to distinguish the three species.

O. nemorosus : Antennae not conspicuously lighter at the base. About 12–16 scales in the comb of the eighth segment ; scales slightly fringed at the base and produced into very long sharp points (fig. 6 *a*). Teeth of pecten with two or three serrations near the base, of which the apical one is much the largest. Gills a little longer than the anal segment, sharply pointed.

O. dorsalis : Antennae conspicuously pale at the base. About 24 scales in the comb of the eighth segment ; scales pointed, but shorter than those of *O. nemorosus* and heavily fringed (fig. 6 *b*). Teeth of pecten with two or three serrations near the base, of which the apical one is considerably the largest. Gills scarcely half as long as the anal segment, bluntly pointed.

O. salinus : Antennae conspicuously pale at the base. About 24 scales in the comb of the eighth segment ; scales blunt-ended, heavily fringed (fig. 6 *c*). Teeth of pecten with three or four serrations near the base, of which the apical one is very little larger than the others. Gills very short, almost globular, the dorsal pair a little longer than broad.

It is very interesting to note that *O. salinus*, which in the adult is so much like *O. nemorosus*, differs more in the larval stage from *O. nemorosus* than *O. dorsalis* does.

Mediterranean specimens of both *O. dorsalis* and *O. salinus* are usually much lighter in colour than British examples, but there is no difference in the genitalia. I cannot agree with Gough that Linnaeus' *Culex aegypti* is *O. dorsalis*; the description seems to me to indicate quite clearly some species of *Stegomyia*.

Ochlerotatus fryeri, Theo. (fig. 7 *b*).

Culicelsa fryeri, Theo., Trans. Linn. Soc. xv., p. 84 (1912).

I have previously given this as a synonym of *O. nigeriensis* (Theo.), but closer examination of the type with fresh material received from Mombasa, British E. Africa (*Dr. J. O. Shircore*), and Magogoni swamp, near Witu, British E. Africa (*S. A. Neave*), shows that it is really distinct. The chief difference is to be found in the male genitalia, the claspers being quite unlike those of *O. nigeriensis*, *O. sudanensis* or *O. durbanensis*; a figure is given herewith. The side-pieces are very stout, their basal lobes being developed into small harpagones which have a short straight terminal spine. Apart from this the species, though rather smaller than *O. nigeriensis*, is of a distinctly stouter build; the sixth tergite of the female abdomen has a narrow pale apical line instead of an apical pair of pale spots, and the basal white bands on the sixth and seventh tergites tend to spread out backwards in the middle line, which is not the case in *O. nigeriensis*. Both species occur in East Africa, *O. nigeriensis* having been received from Zanzibar (*Dr. W. M. Aders*) and Nyasaland (*S. A. Neave*, *Dr. R. Bury*).

Ochlerotatus vexans, Mg.

Culex vexans, Meigen, Syst. Beschr. vi, p. 241 (1830).
Culex articulatus, Rond., Bull. Soc. Ent. It. iv, p. 30 (1872).
Culex sylvestris, Theo., Mon. Cul. i, p. 406 (1901).
Culex vagans, Theo., Mon. Cul. i, p. 411 (1901).
Culicada nipponii, Theo., Mon. Cul. iv, p. 337 (1907).
Culicada minuta, Theo., Mon. Cul. iv, p. 338 (1907).
Culex stenoctrus, Theo., Mon. Cul. iv, p. 395 (1907).
Culicada eruthrosops, Theo., Mon. Cul. v, p. 299 (1910).
Culex pseudostenoetrus, Theo., Mon. Cul. v, p. 343 (1910).
? *Culex nocturnus*, Theo., Mon. Cul. iii, p. 159 (1903).
Culex hirsutum, Ludlow, Psyche, xviii, p. 126 (1911).

I have compared mounts of the genitalia of specimens from Canada, England, India, and Ceylon, and find them absolutely identical. Ficalbi's figure, which has been copied by Theobald and Kertesz, is rather inaccurate, the structure being better represented in the figure given by Howard, Dyar and Knab (Plate 34, fig. 225); even this, however, is not quite correct, the shape of the clasper agreeing with the African *O. dentatus* as figured by me (Bull. Ent. Res. v, p. 277, 1915). *O. dentatus*, however, must be distinct from *O. vexans*, as the tarsi are entirely dark, and there are slight differences in the basal parts of the genitalia. I have not seen a male of *O. nocturnus*, but have included it with some doubt in the synonymy, as the females appear to agree closely with the Oriental form of this species.

It is extremely remarkable that a non-domestic mosquito should have such a wide range as *O. vexans* apparently has, extending over North America, Europe, China,

Japan, India, Ceylon, Philippines, Borneo and perhaps Fiji, male or female specimens from all these countries being in the British Museum collection. Since I can detect no structural differences whatever, I prefer to regard all these specimens as representing a single species, which in different parts of its range is subject to some local variation in size and colour. I can distinguish the three following varieties :—

(1) *vexans*, Mg. (=*articulatus* Rond., =*sylvestris*, Theo.). Pale abdominal bands contracted sharply in the middle, or even sometimes divided into a pair of pale spots. Europe and North America.

(2) *stenoetrus*, Theo. (=*minuta*, Theo., etc.). Pale abdominal bands very little or even not at all contracted in the middle. Size rather smaller on the average than *O. vexans vexans*. Oriental Region.

(3) *nipponii*, Theo. (=*vagans*, Theo. *nec* Wied.). Size as in *O. vexans vexans*, and the basal pale abdominal bands contracted in the same way, but the abdomen has in addition a more or less interrupted pale median dorsal line, and the sixth tergite has a conspicuous apical pale triangle. China and Japan. (This can hardly be Wiedemann's *vagans*, since he does not mention white rings on the tarsi.)

Ochlerotatus minutus, Theo. (fig. 7 *c*).

A single male has been received from Mlanje, Nyasaland (*S. A. Neave*), which I think must belong to the type form of *minutus*, with flat scales over the top of the head ; the specimen is too much rubbed to name with absolute certainty, but if it is correctly associated with the type female from Mashonaland, *O. minutus* must be quite a distinct species from *O. tarsalis* (see below). The male claspers are very peculiar, and are shown in fig. 7 *c* ; the only African species which has rather similar claspers is *O. domesticus*, Theo. *O. minutus* apparently occurs also in West Africa, as females with flat scales on the vertex have been received fron Sierra Leone (*Dr. H. E. Arbuckle*) and the Gold Coast (Obuasi, *Dr. W. M. Graham*, and Bjere, *Dr. A. Ingram*). The dark bands on the under side of the abdomen are much broader in this than in the allied forms.

Figures of the male claspers of *O. tarsalis*, *O. irritans* and *O. nigricephalus* are given for comparison. It may be mentioned that the claspers of *O. argenteopunctatus* and *O. punctothoracis* are very similar to those of *O. tarsalis*, and quite unlike *O. minutus* and *O. domesticus*.

Ochlerotatus tarsalis, Newst. (fig. 7 *d*).

Duttonia tarsalis, Newstead, Ann. Trop. Med. i, p. 18 (1907).

Duttonia africana, Newstead, Ann. Trop. Med. i, p. 20 (1907).

Reedomyia biannulata, Theo., Mon. Cul. iv, p. 263 (1907).

Reedomyia neobiannulata, Theo., Mon. Cul. v, p. 255 (1910).

Reedomyia bipunctata, Theo., Mon. Cul. v, p. 256 (1910).

Neopecomyia uniannulata, Theo., Mon. Cul. v, p. 261 (1910).

Most of the above names were previously given by me (Bull. Ent. Res. iii, p. 21) as synonyms of *O. minutus*, but as stated above I now consider *O. minutus* to be a distinct species, consequently the commoner form must now be known as *O. tarsalis*. I do not think there can be much doubt in regard to the synonymy now given. To

the synonyms given previously I have added *Duttonia africana*, since specimens received from Sierra Leone (*A. Bacot*) have convinced me that it is nothing more than a variety of *O. tarsalis*. On the other hand, since no males have been received from the Seychelles Is., the name *Reedomyia seychellensis* is omitted; and in addition, *Stenoscutus africanus* proves on more careful examination to be a distinct species.

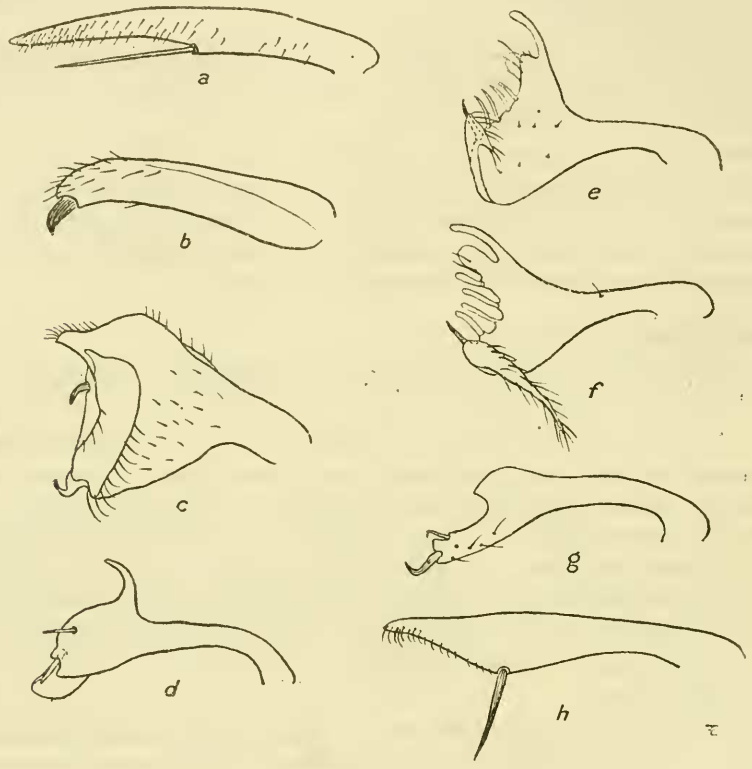

Fig. 7. Male genital claspers of *Ochlerotatus*:—(*a*) *O. adersi*, Edw., sp. n.; (*b*) *O. fryeri*, Theo.; (*c*) *O. minutus*, Theo.; (*d*) *O. tarsalis*, Newst.; (*e*) *O. abnormalis*, Theo.; (*f*) *O. alborentralis*, Theo.; (*g*) *O. irritans*, Theo.; (*h*) *O. nigricephalus*, Theo.

Ochlerotatus abnormalis, Theo. (fig. 7 *e*).

Bathosomyia abnormalis, Theo., Mon. Cul. v, p. 268 (1910).

Stenoscutus africanus, Theo., Mon. Cul. v, p. 263 (1910).

Ochlerotatus minutus var. *stenoscutus*, Edw., Bull. Ent. Res. iii, p. 22 (1912).

I have remounted Theobald's slide of the genitalia of the type male, and give herewith a figure of the clasper. I think there can be no doubt that *S. africanus* is the female of this species. The lateral abdominal spots are dull creamy-white, not brilliant silvery-white as they are in *O. minutus* and *O. tarsalis*.

Ochlerotatus alboventralis, Theo. (fig. 7 *f*).

A good series of both sexes of this species have been received from Kabinda, Katanga (*Dr. J. Schwetz*), and also a single male from Kitui, British East Africa (*T. J. Anderson*). It rather closely resembles *O. abnormalis* and is possibly a geographical form of it; it can be distinguished by the presence of numerous white scales on the mesonotum. There are also some differences in the male genital claspers which are probably of specific importance.

Subgenus Aëdes, Mg.

A considerable number of Oriental species must be included with *A. cinereus* in this subgenus, the majority of them being so extremely similar in appearance that it is difficult to find any characters, apart from those of the genitalia, to separate them. When however the genitalia are examined, their structure is so extraordinarily diverse that it is very difficult even to homologise the different parts. Thus the nine species *ceylonicus, virilis, singularis, uncus, leicesteri, pseudomediofasciatus, yerburyi, varietas* and *fragilis*, whose genitalia are shown in fig. 8 *a–i*, apparently only differ externally in the width and position of some of the wing scales and the shape of the pale abdominal markings, while several appear to be absolutely indistinguishable apart from genital characters. All these species have a reddish-tinged thorax; two other species, *butleri* and *panayensis* (genitalia, fig 8 *j* and *k*) differ chiefly in having a blackish thorax. These eleven species, together with *A. cinereus*, are the only ones of which I have seen males, but doubtless many others occur in the Oriental region. Theobald's *pseudodiurna* is probably distinct from any of those figured here.

Aëdes cinereus, Mg.

Aëdes cinereus, Mg., Syst. Beschr. i, p. 13 (1818).

Aëdes fuscus, O.S., Bull. U.S. Geol. Surv. iii, p. 191 (1877).

There is, I think, no doubt that the European and North American species of *Aëdes* are one and the same. So far as I have seen, there is very little variation among British examples, except that the thorax of the male is very often quite black instead of reddish. The abdomen in these specimens is always dark brown above, with a pale lateral longitudinal stripe, the edge of which forms a straight line. Some of the Canadian specimens in the British Museum are coloured in exactly the same way; others however have pale basal bands on the abdominal segments, and in these the upper margin of the lateral pale stripe is indented towards the apex of each segment. Both these forms have the male genitalia absolutely identical in structure with those of British examples, and it therefore seems justifiable to conclude that we are dealing with only one species, which is more variable in North America than it is in Europe..

Aëdes ceylonicus, sp. nov. (fig. 8 *a*).

Genitalia: Ninth tergite with a pair of terminal projections as in *A. singularis*, but the clasper is minute. External characters as in *A. varietas*, Leic.

One male from Colombo, Ceylon (*K. McGahey*).

Aëdes yerburyi, sp. nov. (fig. 8 *g*).

Genitalia: Dorsal side with a pair of enormous lobes, which may be developed either from the ninth tergite or from the side-piece, I am not sure which. Claspers small. A long, thick, sinuous rod possibly represents the harpes. External characters as in *A. varietas*, Leic.

One male from Kitli station, Ceylon, 29.xi.1891 (*Lt.-Col. Yerbury*).

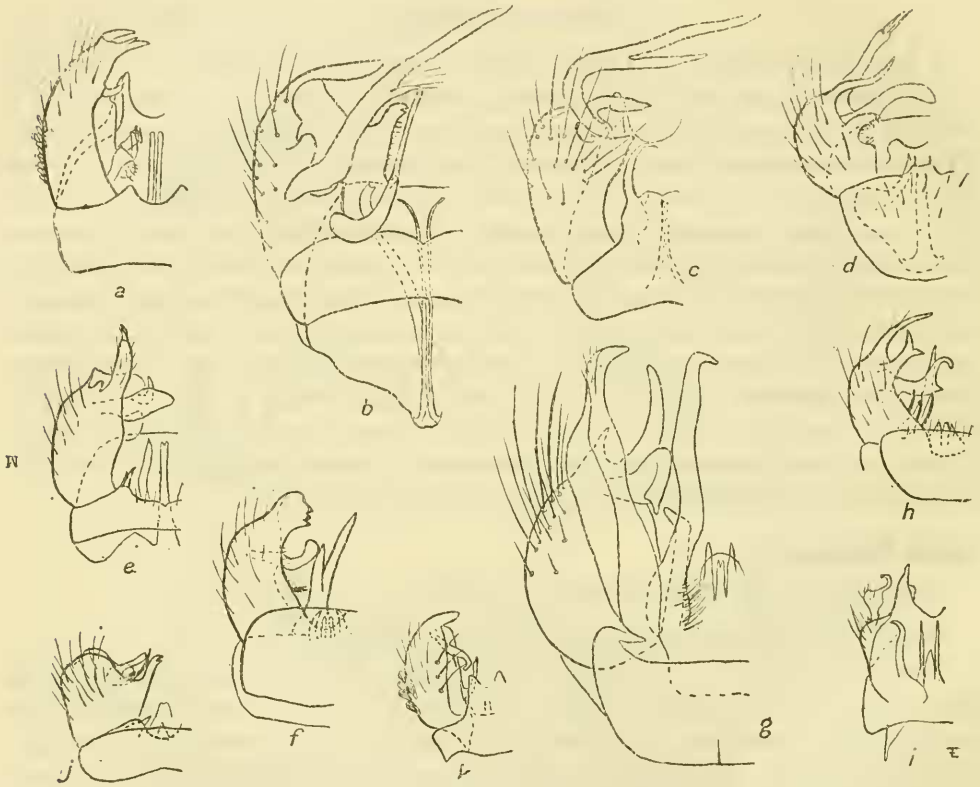

Fig. 8. Male genitalia of Oriental species of *Aëdes*, all to the same scale :— (*a*) *A. ceylonicus*, Edw., sp. n., ventral view ; (*b*) *A. virilis*, Leic., ventral view ; (*c*) *A. singularis*, Leic., ventral view ; (*d*) *A. uncus*, Theo., dorsal view ; (*e*) *A. leicesteri*, Edw., sp. n., ventral view ; (*f*) *A. pseudomediofasciatus*, Theo., dorsal view ; (*g*) *A. yerburyi*, Edw., sp. n., dorsal view ; (*h*) *A. varietas*, Leic., dorsal view ; (*i*) *A. fragilis*, Leic., ventral view ; (*j*) *A. butleri*, Theo., dorsal view ; (*k*) *A. panayensis*, Ludl., ventral view.

Aëdes leicesteri, sp. nov. (fig. 8 *e*).

Genitalia: Ninth tergite with its posterior edge simple. Ninth sternite with a pair of projections, each bearing two spines. External characters as in *A. varietas*.

One male from Kuala Lumpur, Federated Malay States, taken by stream in Ampang Jungle, 21.v.1904 (*Dr. G. F. Leicester*).

Aëdes uncus, Theo. (fig. 8 *d*).

This species was described by Theobald from a single female from Selangor ; it is impossible to say what male really belongs to it, but for convenience I have associated with it two males from Dr. Leicester's collection.

Aëdes singularis, Leic. (fig. 8 *c*).

A male of this species, agreeing well with Leicester's type from Kuala Lumpur, has been received from Kuching, Sarawak (*J. C. Moulton*). This is the only species of this group which I have seen from more than one country, but the fact that one at least is not confined to a small area would seem to indicate that we are here dealing with distinct species and not with mere local races.

Subgenus Skusea, Theo.

Skusea pembaensis, Theo.

Ochlerotatus pembaensis, Edw., Bull. Ent. Res. v, p. 277 (1915).

I have previously (Bull. Ent. Res. iv, p. 229, 1913) mentioned *S. funerea* as the type species of *Skusea*, but in doing so had overlooked the fact that Blanchard had already designated *S. pembaensis* as the type. The male of *funerea* is apparently still unknown, but it is probable that it will prove to be allied to *S. pembaensis* in respect of the palpi and genitalia.

Skusea amesii, Ludlow.

Stegomyia amesii, Ludlow, J. N. Y. Ent. Soc. xi, p. 139 (1903).

Stegomyia fusca, Leic., Cul. of Malaya, p. 92 (1908).

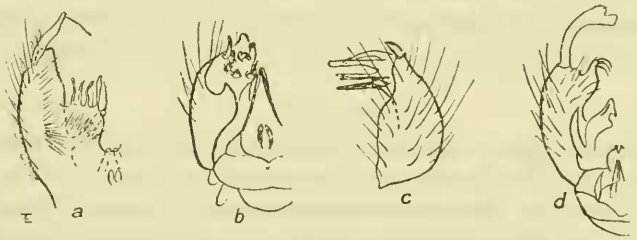

Fig. 9. Male genitalia of *Skusea* :—(*a*) *S. amesii*, Ludl. ; (*b*) *S. simplex*, Theo., ventral view ; (*c*) *S. simplex*, Theo., side view of side-piece ; (*d*) *S. longirostris*, Leic.

This species is included here for want of a better place ; it resembles *Stegomyia* except for the almost uniform dark colouring, but the genitalia are very remarkable in having two basal lobes to the side-pieces ; one, dorsal, forming the harpagone ; the other, ventral, bearing five long processes. These processes are perhaps homologous with those of *pembaensis* and *simplex* ; if this is so, their apical position in these two species is only secondary. The genitalia of *S. amesii* are shown in fig. 9 *a*. I believe the synonymy given above is correct, though the only male specimens I have seen are from the Malay Peninsula. In any case, when *Skusea* and *Stegomyia* are regarded as subgenera of *Aëdes*, Leicester's name is preoccupied by Osten-Sacken's *Aëdes fuscus*.

Skusea simplex, Theo.

Ficalbia simplex, Theo., Mon. Cul. iii, p. 297 (1903).

Aëdes simplex, Edw., Bull. Ent. Res. iv, p. 238 (1913).

The simple claws of the female and the long processes of the male genitalia would seem to justify the association of this species with *pembaensis*, although the claspers are much reduced, and, as in *Aëdes*, have no distinct spine. I have shown the structure of the genitalia as well as I could make it out in the single specimen (fig. 9 *b* and *c*).

Skusea longirostris, Leic. (fig. 9 *d*).

Ficalbia longirostris, Leic., Cul. of Malaya, p. 228 (1908).

Although not at all closely related to the species mentioned above, this species would seem to be better placed here than in *Aëdes*, owing to the simple female claws. As in most species of *Aëdes*, the male genital clasper seems to be without any trace of an articulated spine.

Genus Taeniorhynchus, Arr.

Taeniorhynchus nigrosignatus, nom. nov.

Taeniorhynchus conopas, Theo., Mon. Cul. i, p. 202 (1901) (nec *Culex conopas*, Frauenf.).

? *Pseudotaeniorhynchus conopas* var. *giblini*, Taylor, Trans. Ent. Soc., 1914, p. 198.

It is quite obvious from Frauenfeld's description of *C. conopas* that the insect he had was not one of the yellow species of *Taeniorhynchus* with black-ringed legs; what it was is impossible to say without seeing the type, since the description is quite inadequate, but it may possibly have been *Mansonioides uniformis*.

So far as can be judged from Taylor's description of *T. giblini*, this form shows sufficient differences to be distinguished specifically from Oriental specimens, and as there is no other name available for these latter the above new designation is proposed.

Genus Culex, L.

Since the different groups of *Aëdes* are now regarded as only subgenera, it is desirable that the name *Culex* should also be employed in a rather wider sense than that in which I have used it. The structural differences between *Culex*, *Culiciomyia*, *Lophoceratomyia* and *Micraëdes* are of much less moment than those between the various groups of *Aëdes*, and it is doubtful whether some of the former names should be retained even in a subgeneric sense. *Culiciomyia* and *Lophoceratomyia* are fairly distinct, and so are the large carnivorous forms *Lutzia* and *Jamesia*, but *Cyathomyia* might well be regarded as merely somewhat aberrant species of *Culex*. An undescribed species from Japan affords a good connecting link between *Cy. brevipalpis*, Giles, and typical *Culex*, and among the American species there are apparently some with male palpi intermediate in length between those of *Cy. brevipalpis* and *Micraëdes inconspicuosus*.

Subgenus Culex, L.

Culex tritaeniorhynchus, Giles.

This species has so far only been recorded from the Oriental and Eastern Palaearctic regions, but by a strange coincidence I recently received for examination on the same day a male from Zanzibar (*Dr. W. M. Aders*) and a number of females from Accra,

Gold Coast (*Dr. J. W. Scott Macfie*). Subsequent re-examination of the British Museum series of *C. thalassius* revealed one female of *C. tritaeniorhynchus* from Weshiang, Gold Coast (*Dr. H. F. Hamilton*), and a further series representing both sexes has since been received from Accra.

I have previously stated (Bull. Ent. Res. iv, p. 233) some of the characters by which *C. tritaeniorhynchus* may be distinguished from its two nearest allies, *C. sitiens* and *C. vishnui*, but in doing so I overlooked some of the most important, which are as follows :—On the under side of the proboscis of the female the pale ring is much extended basally, though its edges are ill-defined ; often the basal three-fifths of the proboscis is almost all pale beneath, and frequently near the base the pale scales extend on to the side or even on to the dorsal surface, in which case the proboscis may appear to have two pale rings. The tip of the male palpi is dark (in *C. vishnui* it is narrowly and in *C. sitiens* rather broadly pale). The long joint of the male palpi has one narrow pale ring, and one broad one (in the two other species the two pale rings are equally broad). Finally the wing scales of *C. tritaeniorhynchus* are longer and narrower than in the other two. The African specimens are rather darker than those from the Oriental region, and the basal extension of the pale ring on the under side of the proboscis is not always observable.

Culex thalassius, Theo.

This seems to be the representative of *C. sitiens* in the Ethiopian region south and west of Somaliland. The genitalia of the two are practically identical, and *C. thalassius* seems only to differ in the absence of scattered pale scales on the femora and tibae. *C. accraensis* and *C. neotaeniorhynchus* are, as I have already stated, synonyms of *C. thalassius*, but I find I was wrong in including *C. bifoliata* here also ; after carefully mounting and examining the genitalia of the two males on which Theobald based his description of *C. bifoliata*, I find that one was really *C. duttoni* and the other *C. invidiosus*.

Culex vishnui, Theo.

Culex perplexus, Leic., Cul. of Malaya, p. 150 (1908).

The type male and female of Leicester's *C. perplexus* have recently been presented to the British Museum by Dr. A. T. Stanton, from the Kuala Lumpur collection. The male genitalia are identical with those of *C. vishnui*, and *C. perplexus* may therefore be regarded as a variety of this species in which the thorax has more definite markings than usual. *C. vishnui* is subject to a good deal of variation.

Culex whitmorei, Giles.

Culex loricatus, Leic., Cul. of Malaya, p. 151 (1908).

The type of *C. loricatus* has also been presented by Dr. Stanton, and proves to be identical with *C. whitmorei*.

Culex fuscocephalus, Theo.

Culex uniformis, Leic., Cul. of Malaya, p. 159 (1908).

The above synonymy is apparent from the description, although I have not seen any of Leicester's specimens. The species seems to be widely distributed in the Oriental region, specimens having been received from Dr. Stanton from Bangkok, Kuala Lumpur, Batavia and Makasser.

Culex rima, Theo.

I endeavoured to distinguish this from *C. insignis*, Carter, by the absence of distinct apical white bands on the abdominal segments. However the type of *C. rima* has traces of these bands, and there is no doubt that they are normally present in this species, though occasional specimens are found without them. *C. insignis* may therefore be synonymous with *C. rima*, though there are slight differences in the male genitalia between specimens from West Africa and from Uganda, from which latter country *C. insignis* was described. I do not consider that these differences are of greater than varietal significance.

Subgenus Lophoceratomyia, Theo.

This group can be distinguished from *Culex* proper by the peculiar hair- or scale-tufts on the male antennae, and also by the scanty scaling of the wings in both sexes, due to the practical absence of the lateral series of scales except towards the tip of the wing. In the least specialised species, such as *L. hewitti* and *L. minutissima*, only the ninth joint of the male antennae bears a long pencil of matted hairs on the inner side, pointing obliquely downwards; the more typical species however have variously formed scale-tufts on the sixth, seventh, eighth and tenth joints as well. The larvae of three species (*L. uniformis*, *L. mammilifer* and *L. minor*) have been received at the British Museum; there seems to be nothing to distinguish them generically from *Culex*. The siphon is long and thin and the comb on the eighth segment is in the form of a triangular patch.

The group has hitherto been recorded only from the Oriental region, but, as indicated below, two Australian species described by Theobald under *Culex* really belong here, and it is possible that some of Taylor's recently described species do also. The following is an attempt to tabulate the Oriental species. The table necessarily applies chiefly to the males, as it is often almost impossible even by comparison of specimens to determine females alone.

1. Basal joint of male antennae simple; species often reddish-tinged .. 2
   Basal joint of male antennae with a blunt prominence on the inner side; blackish species 7
2. Sixth to eighth joints of male antennae without scale-tufts; abdomen banded *minutissima* (Theo.).
   Sixth to eighth joints of male antennae with scale-tufts 3
3. Scales on sixth joint almost hairlike, only visible in certain positions .. 4
   Scale-tuft on sixth joint obvious, the scales much broader 5
4. Smaller, blackish species.. .. .. *nigra*, Leic.
   Larger, reddish species .. .. *rubithoracis*, Leic.
5. Scale-tuft on sixth joint very large, the lower scales white .. *fraudatrix*, Theo.
   Scale-tuft on sixth joint smaller, the scales all dark 6
6. Abdomen unbanded .. .. *barkeri* (Theo.).
   Abdomen banded .. .. *taeniata*, Leic.
7. Sixth to eighth joints of male antennae without scale-tufts.. 8
   Sixth to eighth joints of male antennae with scale-tufts 9

8. Male palpi almost as long as the proboscis .. .. .. *hewitti*, Edw.
   Male palpi only about half as long as the proboscis .. .. *curtipalpis*, Edw.
9. Male palpi a little shorter than the proboscis ; scale-tuft on sixth antennal joint bright yellow.. .. .. *eminentia*, Leic.
   Male palpi at least as long as the proboscis ; scale-tuft on sixth antennal joint of a duller colour 10
10. Last two joints of male palpi rather longer and distinctly hairy ; Ceylon species *uniformis*, Theo.
    Last two joints of male palpi rather shorter and almost hairless ; Malayan species 11
11. A distinct scale-tuft on the sixth antennal joint of the male *mammilifer*, Leic.
    Scales on sixth antennal joint of male hairlike and inconspicuous *minor*, Leic.

Lophoceratomyia being regarded as only a subgenus of *Culex*, the names *nigra* and *taeniata* are both preoccupied, but I refrain from proposing substitutes for them as I am doubtful if they are specifically distinct from *L. rubithoracis* and *L. taeniata* respectively. I have used the name *eminentia*, Leic., instead of the earlier *brevipalpus*, Theo., in order to avoid confusion with *Culex* (*Cyathomyia*) *brevipalpis*, Giles ; these names are too much alike for both to be retained.

Lophoceratomyia barkeri, Theo.

I now consider that my *L. quadripalpis* (Bull. Ent. Res., v, p. 80, 1914) is synonymous with *L. barkeri* and *L. sylvestris*.

Lophoceratomyia uniformis, Theo.

I have previously stated (Bull. Ent. Res., v, p. 80, 1914) that *L. uniformis* is identical with *L. mammilifer*, but a more careful examination proves that this is not so. Larval skins of *L. uniformis* from Ceylon, with the adults bred from them, were presented to the museum by Mr. E. E. Green in 1914 ; the larvae are very peculiar in having the whole integument of the thorax and abdomen covered with minute hairs. I thought that this might prove to be a character of *Lophoceratomyia*, and was much surprised when in 1916 Dr. A. T. Stanton sent larval skins of *L. mammilifer* from Ginting Simpah, Fed. Malay States, which had a normal bare integument. A subsequent re-examination of the adults revealed the difference indicated in the key.

Lophoceratomyia minor, Leic.

The male specimens in Leicester's collection, which apparently can only be this species, differ as follows from his description :—The palpi are barely as long as the proboscis ; sixth antennal joint with very inconspicuous hair-like scales on its outer side ; the larger claw on the fore and mid legs is toothed as well as the smaller. In spite of these differences I believe I must have correctly identified the specimens, as there are none in the collection which fit Leicester's description, and none of his descriptions fit these specimens better than that of *L. minor*. I do not know whether the name *L. minor* is antedated by *Culex minor*, Theo. (Oct. 1908), so allow it to remain for the present, as *C. minor* is probably synonymous with *C. fuscocephalus*, Theo.

Bred specimens agreeing with those above referred to have been received from Dr. Stanton from Ginting Simpah, Fed. Malay States, 1915. The larval skin is very similar to that of *L. mammilifer* (received from the same place in 1916), but the gills are twice as long as the anal segment instead of only a little longer, and there are some other differences.

Lophoceratomyia cylindrica, Theo.

Culex cylindricus, Theo., Mon. Cul. iii, p. 202 (1903).

The antennal structure of this species is exactly the same as in *L. minutisima* (Theo.), which it also resembles in its banded abdomen.

Lophoceratomyia chaetoventralis, Theo.

Neomelanoconion chaetoventralis, Theo., Mon. Cul. v, p. 461 (1910).

Though known only from the type female, this also is evidently a species of *Lophoceratomyia*. It appears to be very much like *L. cylindrica*, but has white scales round the front margin of the mesonotum, which the latter has not.

Subgenus Micraëdes, Coq.

It is doubtful whether all the species of *Culex* with the palpi equally short in both sexes are genetically related, but it will perhaps be convenient to class them all together in one subgenus. The name of this subgenus should perhaps be *Aëdinus* rather than *Micraëdes*, since Howard, Dyar and Knab include Lutz's genus in the synonymy of *Culex*.

Micraëdes malayi, Leic.

Aëdes malayi, Leic., Cul. of Malaya, p. 184 (1908).

Aioretomyia aëdes, Leic., Cul. of Malaya, p. 189 (1908).

I overlooked the above synonymy in my paper on Synonymy of Oriental Culicidae. The types agree.

Genus Theobaldia, N.-L.

Theobaldia longiareolata, Mcq.

Culex longiariolatus, Mcq., Dipt. Exot. i, p. 34 (1838).

Culex spathipalpis, Rond., Bull. Soc. Ent. It. iv, p. 31 (1872).

Culex serratipes, Becker, Berlin Mitt. Zool. Mus. iv, p. 78 (1908).

As Theobald suggests, it is fairly certain that Macquart's species is the same as Rondani's; it is the only European gnat to which Macquart's description of the venation will apply, and therefore this old name ought to be used. Becker's *C. serratipes* is also quite evidently the same from the description.

It may be mentioned here that Becker's *C. anguste-alatus* and *C. albopalposus* are probably both *Stegomyia fasciata*; the former apparently being described from a specimen with the last two hind tarsal joints broken off, and the latter from one with a rubbed thorax.

Genus Aëdomyia, Theo.

Aëdomyia africana, N.-L. (fig. 10 *c*).

Neveu-Lemaire described this species from a single male which he said had only a median pale ring on the proboscis and no white scales on the palpi. I have not seen

a specimen answering to this description, but the numerous specimens of *Aëdomyia* received from various parts of Africa show a good deal of variation in the amount of white on the proboscis and palpi, and I therefore incline to believe that Neveu-Lemaire only described an unusually dark specimen of the species which is widely distributed in Africa. This species I have previously identified with the Oriental *A. catasticta*; there are, however, slight but apparently constant differences between the two, and I therefore propose to use Neveu-Lemaire's name for what I believe is likely to prove the only African species of the genus.

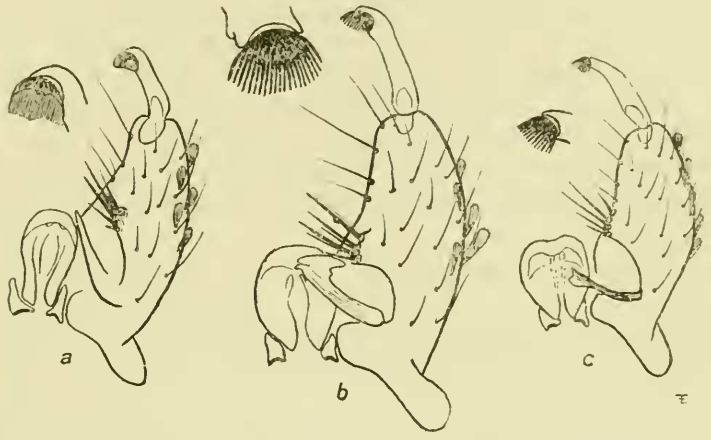

Fig. 10. Male genitalia of *Aëdomyia* seen from below, with tip of clasper further enlarged :—(*a*) *A. squamipennis*, Arr., from British Guiana; (*b*) *A. catasticta*, Knab, from Sarawak; (*c*) *A. africana*, N.-L., from Nigeria.

A. africana differs as follows from *A. catasticta* :—It is on the average distinctly smaller; the wings have a well-defined clear yellow patch at the base just below the costa, in which no darker scales are included; the yellow patch on the mesonotum is more sharply defined and rather larger, and its sides are not indented by patches of dark scales; the claspers of the male genitalia are somewhat narrowed instead of slightly expanded towards the tip, and their terminal spine is divided into about 15 instead of about 20 teeth (fig. 10 *c*).

Figures of the male genitalia of *A. catasticta* and *A. squamipennis* are given for comparison. It is possible that *A. catasticta* is the same as the Australian *A. venustipes*, but this is not likely, since Taylor speaks of white scales being present on most of the joints of the female antennae, whereas in the three species known to me only the first two antennal joints bear scales.